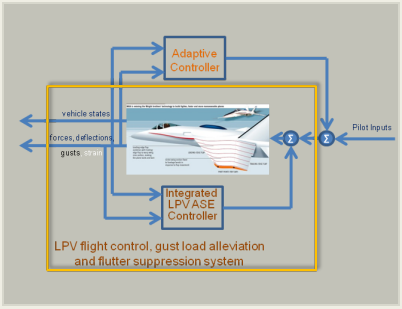
Small Business Innovation Research/Small Business Tech Transfer

Adaptive Linear Parameter Varying Control for Aeroservoelastic Suppression, Phase II

Completed Technology Project (2012 - 2015)

Project Introduction

Adaptive control offers an opportunity to fulfill aircraft safety objectives though automated vehicle recovery while maintaining performance and stability requirements in the presence of unknown or varying operating environment. Future aircraft are a natural application of adaptive control. These aircraft will be more fuel efficient, have longer operating ranges though more flexible aircraft structures. This increased flexibility will tightly couple structural and rigid body modes. The traditional control approaches to address the aeroservoelastic (ASE) will not work due to this coupling. Furthermore, the application of adaptive control to these flexible aircraft may result in undesired ASE excitation leading to structural damage or failure. Hence an integrated flight control system is needed for gust load alleviation, flutter suppression and rigid body control of the aircraft which works in concert with the adaptive control system for improved resilience and safety. MUSYN proposes an integrated approach based on linear, parameter-varying (LPV) control to the design of integrated flight control algorithms. Phase II research is focused on developing a fully functional prototype tool suite to model, identify, analyze, design, simulate and implement in real-time, linear, parameter-varying (LPV) ASE controllers. The objective is to combine the integrated LPV flight control system with adaptive control to preserve rigid body performance during upsets while mitigating ASE effects. The prototype LPV tools will be used to analyze and design an inner-loop LPV ASE and adaptive outer-loop controller for the MAD-MUTT test vehicle. The LPV designs will be validated in software-in-the-loop and hardware-in-the-loop testing prior to their implementation and flight test on the MAD-MUTT vehicle. The objective is to demonstrate the viability of the LPV tools suite to analyze and synthesize integrated controllers for highly flexible aircraft.



Adaptive Linear Parameter Varying Control for Aeroservoelastic Suppression

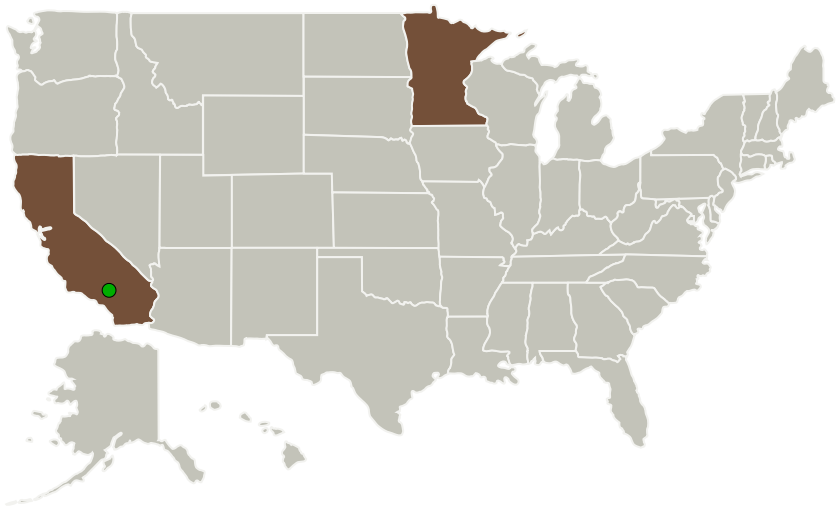
Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Adaptive Linear Parameter Varying Control for Aeroservoelastic Suppression, Phase II

Completed Technology Project (2012 - 2015)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
MUSYN Inc	Lead Organization	Industry	Minneapolis, Minnesota
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California

Primary U.S. Work Locations	
California	Minnesota

Project Transitions

April 2012: Project Start

May 2015: Closed out

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

MUSYN Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Arnar Hjartarson

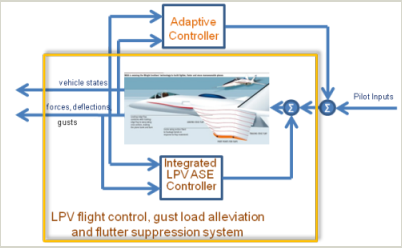
Co-Investigator:

Arnar J Hjartarson

Adaptive Linear Parameter Varying Control for Aeroservoelastic Suppression, Phase II

Completed Technology Project (2012 - 2015)

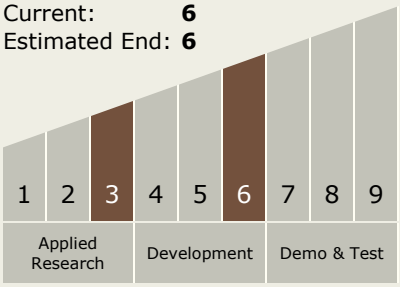
Images



Project Image
Adaptive Linear Parameter Varying Control for Aeroservoelastic Suppression
(https://techport.nasa.gov/image/127999)

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.3 Aeroelasticity

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System